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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

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In the Matter of:	)	
	)	
Federal-State Joint Board on Universal Service	)	CC Docket No. 96-45
	)	
	)	
Forward-Looking Mechanism for High Cost Support for Non-Rural LECs	)	CC Docket No. 97-160

COMMENTS OF GTE

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Summary

Basing high cost support on the output of a hypothetical forward-looking cost proxy model, as proposed in the FNPRM, will understate the actual forward-looking costs of providing universal service and therefore violate Congress's mandate that universal service support be "sufficient." (The risk of insufficient support is aggravated by the Commission's intent to consider revenues from services outside the universal service "package" in offsetting the costs predicted by the model.) The LECs' actual forward-looking costs are driven by their existing network plant – the types and locations of their switches and the routes of their interoffice transport facilities, among other things. Those costs, therefore, can best be determined by an engineering model which would consider existing network design and technology. In contrast, cost proxy models, by definition, base cost estimates on a hypothetical network that disregards existing network technology and investment.

The Hatfield Model is particularly egregious in this regard. That model intentionally ignores real-world costs and flouts well-established engineering standards in an effort to secure access to incumbent LEC networks at the lowest possible (and entirely uneconomic) price. The problems with Hatfield are legion and well-documented. Among other flaws, Hatfield employs an inadequate and spurious mathematical function as the foundation for its end office switching investment calculations, violates accepted switch engineering guidelines, overlooks critical switching components, excludes various element costs, and uses entirely unreliable input data. With respect to interoffice transport facilities (IOF), Hatfield understates

route-to-air ratios (producing results that are mathematically impossible), improperly classifies switches, incorrectly models the majority of IOF routes, fails to account for such obstacles as bodies of water, buildings, and mountains, and uses a network model that would render the entire SS7 signalling system inoperable. The Hatfield Model is inadequate and unreliable by any conceivable measure, and it should be firmly and finally rejected in this proceeding.

The most appropriate short-term course is for the Commission to permit individual carriers to use state-approved forward-looking engineering models to estimate the costs of providing universal service. Such models would be based on in-place technology and standard engineering practices, and would therefore produce more reliable results that a cost proxy model based on a hypothetical network design. The resulting costs should then be compared against the carrier's embedded costs. To the extent any shortfall due to under-depreciation exists, the carrier must be given an opportunity to recover that difference through a specific recurring charge in order to avoid an unconstitutional taking.

In addition, the Commission should expeditiously initiate a proceeding to develop a competitive bidding mechanism for determining and allocating universal service support. Adoption of GTE's auction proposal would assure that support is both sufficient and efficient. In addition, by substituting market forces for regulatory intervention, an auction process would avoid the inevitable resource misallocations resulting from imperfect modeling.

GTE's position with respect to the specific questions raised in the FNRPM stems from its belief that a real-world, engineering-based forward-looking cost model is the

best interim means of establishing the costs of providing universal service. For example, the Commission should not waste time and resources modeling the placement of hosts and remotes; it should use existing switch types and locations (as identified in the Local Exchange Routing Guide), which reflect incumbent LEC efforts to optimize network efficiency. Likewise, there is no need to decide what capacity constraints should be used to model placement of additional switches in a serving area. The deployment of in-place switches is based on existing and expected demand and a variety of other factors that would be difficult to model, and there is no evidence of imprudent investment to justify second-guessing the LECs' decisions. Finally, as summarized above and detailed herein, the Commission should not utilize any aspect of the Hatfield platform for modeling the interoffice network. That model severely understates inter-office facility costs and ignores fundamental engineering principles. Rather, the Commission should utilize existing data regarding routes, trunking arrangements, and similar matters in determining forward-looking costs.

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COMMENTS OF GTE SERVICE CORPORATION

GTE Service Corporation and its affiliated domestic telephone operating companies (collectively "GTE")[1] respectfully submit their Comments on the Further Notice of Proposed Rulemaking ("FNPRM") in the above-captioned proceedings.[2] As explained in GTE's filings in CC Docket No. 96-45, the Commission's decision to base universal service support on hypothetical forward-looking costs developed through a cost proxy model (and to consider revenues obtained from services outside the universal service "basket") contravenes the statutory requirement that universal service support be "sufficient."[3] GTE's general criticism of the approach underlying the

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1 GTE Alaska, Incorporated, GTE Arkansas Incorporated, GTE California Incorporated, GTE Florida Incorporated, GTE Hawaiian Telephone Company Incorporated, The Micronesian Telecommunications Corporation, GTE Midwest Incorporated, GTE North Incorporated, GTE Northwest Incorporated, GTE South Incorporated, GTE Southwest Incorporated, Contel of Minnesota, Inc., and Contel of the South, Inc.

2 FCC 97-256 (released July 18, 1997).

3 47 U.S.C. § 254(b)(5), (d).

FNPRM,[4] as well as its recommendations for an alternative approach that will provide sufficient and efficient funding pending development of a market-based auction mechanism, are discussed in section I below. GTE responds in section II of these comments to certain of the "platform" issues raised in sections III.C.3 and III.C.4 of the FNPRM and reiterates therein and in Appendix A its opposition to any use of the Hatfield Model in predicting forward-looking costs.

I. THE PROPOSAL TO DEVELOP A HYPOTHETICAL FORWARD-LOOKING COST PROXY MODEL IS INCONSISTENT WITH SECTION 254.

In Section 254 of the Communications Act, Congress directed that "[t]here should be specific, predictable, and *sufficient* Federal and State mechanisms to preserve and advance universal service."[5] Notwithstanding this mandate, the Commission determined in the *Universal Service Order* that it will base the level of support on the hypothetical forward-looking cost "of constructing and operating the network facilities and functions used to provide the supported services," rather than actual costs.[6] Compounding the risk that the adopted universal service mechanism will

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[4] This objection pertains to all aspects of the FNPRM, not just those dealt with in the initial round of comments. In future comment rounds, GTE will incorporate by reference the discussion in section I below in order to preserve its fundamental objections to the Commission's approach to universal service support.

[5] 47 U.S.C. § 254(b)(5) (emphasis added); *see also id.* § 254(d) ("Every telecommunications carrier that provides interstate telecommunications services shall contribute, on an equitable and nondiscriminatory basis, to the specific, predictable, and sufficient mechanism established by the Commission to preserve and advance universal service.").

[6] *Universal Service Order*, CC Docket No. 96-45, FCC 97-157 (released May 8, (Continued...)

generate insufficient support to cover the actual costs of providing universal service, the Commission also held that the support level would be the difference between the hypothetical costs and "a nationwide benchmark based on average revenues per line for local, discretionary, interstate and intrastate access services, and other telecommunications revenues ...."[7] The FNPRM takes these decisions as a given and seeks "comment on the specific mechanisms the Commission should adopt to calculate for non-rural carriers the forward-looking economic cost of providing supported services ...."[8]

Real carriers, operating in the real world, will incur a level of costs in providing universal service that is determined by their in-place network facilities. That is, the forward-looking costs of providing universal service are dictated largely by past investment and engineering decisions. GTE understands the Commission's reluctance to base universal service cost support solely on booked costs, and does not advocate such an approach in these Comments.[9] The Commission must recognize, however, that any hypothetical cost proxy model will produce results reflecting the real world costs of particular carriers only by sheer accident – and, that the cost proxy models

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(...Continued)
1997), at ¶ 224.

[7] *Id.*, ¶ 259. The "federal share of the difference between a carrier's forward looking economic cost of providing supported services and the national benchmark will be 25 percent." *Id.*, ¶ 269.

[8] FNPRM, ¶ 1.

[9] *Universal Service Order*, ¶¶ 227-228.

under consideration, even if modified, almost certainly will understate the true costs of providing universal service and therefore violate the sufficiency mandate of Section 254.

In the long run, a market-based approach to determining high cost support levels is plainly optimal. Under an auction proposal, like that advanced by GTE, firms operating under well-understood and competitively neutral expectations regarding such matters as service quality, equal access, and pricing flexibility will determine the efficient forward-looking costs of providing universal service far more accurately than any regulatory model. GTE accordingly urges the Commission rapidly to act on its stated intent to "consider the use of competitive bidding as a mechanism for determining universal service support levels."[10]

In the interim, the Commission should permit carriers to utilize state-approved, company-specific engineering cost models to determine the forward-looking costs of providing universal service to a disaggregated geographic level (e.g., down to individual Census Block Groups).[11] These models would be based on a company's existing network; that is, they would use existing wire center locations (as required by the Commission) as well as existing switch types, interoffice transport facilities, loop technology, and other real-world factors. As a result, each model should produce

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[10] FNPRM, ¶ 1.

[11] Obviously, smaller carriers may wish to use a generic model rather than develop their own engineering studies.

company-specific forward-looking costs that are realistic in light of actual operating conditions and existing technology.

Importantly, the output of the model should be verified against the company's embedded costs. To the extent a shortfall exists, which results from under-depreciation of embedded plant, the incumbent LECs must be afforded an opportunity to recover that shortfall through a specific recurring charge independent of the universal service funding mechanism. Failure to permit such recovery would amount to an unconstitutional taking, as GTE has detailed previously in its comments in this and other Commission proceedings.[12]

The approach set out in the FNPRM is clearly inferior to use of an engineering cost model based on actual network configurations. Any cost proxy model, no matter how complex, can not possibly consider all real-world factors that determine costs for individual companies. As a result, the hypothetical costs generated by a cost proxy model are likely to deviate substantially from actual costs, which is reason enough to reject such a model. The criteria established by the Commission exacerbate the problems of using a cost proxy model by virtually guaranteeing that the predicted costs will substantially understate the actual costs of providing universal service. This is true for several reasons.

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[12] In the *Universal Service Order* (at ¶ 230 n.593), the Commission expressed a vague assurance that "issues related to legacy costs will be addressed in the Access Reform Proceeding." The *Access Reform Order*, however, contained no mechanism for assuring an opportunity to recover these costs and the Commission has yet to issue the promised action regarding legacy cost recovery. The Commission cannot avoid judicial scrutiny of the confiscatory effect of its actions by continually deferring cost recovery issues to future proceedings.

First, the Commission has announced that the cost proxy model will consider only hypothetical forward-looking costs and will disregard the actual forward-looking costs of providing service given existing network facilities. In doing so, the Commission took it on faith that the cost levels produced by the model will be "efficient," and that cost levels based on embedded costs and existing investment are "inefficient." The ILECs' in-place networks, however, result from prudent, approved investments.[13] Those past investments determine the future, real-world costs of continuing to provide universal service using existing network facilities. If the costs of building and operating a network are currently declining over time – as the Commission accepts to be true – then, by definition, a funding mechanism that provides reimbursement only for hypothetical forward-looking costs will not assure sufficient funding.[14] In essence, the Commission has chosen to sacrifice ILEC cost recovery, which arbitrarily penalizes the ILECs for their status as incumbent carriers.

Second, the Hatfield model in particular (and BCPM to a lesser but still significant extent) suffers from a multitude of methodological flaws and utilizes

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[13] There is no evidence in the record that ILEC investments were inefficient, and the Commission did not assert this to be true in declining to base funding on embedded costs.

[14] If new equipment can be placed at lower cost than in the past, either because technology has been improved or because input prices have declined, then the economic value of existing plant has fallen since it was installed. If correct economic depreciation had been used, this decrease would have been recognized and recovered as a cost of doing business during the time the company owned the asset. The depreciated, embedded plant would therefore be just as efficient, if valued correctly, as new plant would be. However, uneconomic depreciation has prevented ILECs from recovering the economic costs of existing plant, virtually guaranteeing that hypothetical forward-looking costs will be less than the ILECs' actual costs.

unrealistically low inputs, resulting in a severe understatement of actual costs. For example, both models under consideration are static. That is, they do not consider growth,[15] uncertainty, indivisibility of investment, breakage, or the necessity for repeated placement of facilities. All of these factors, however, tend to increase actual costs because network designers must carry out a dynamic optimization that seeks to anticipate all unknowns to the greatest extent possible.[16] GTE has detailed these and other egregious problems in past comments[17] and attaches as Appendix 1 hereto a

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[15] For example, the Hatfield Model ignores the fact that ILECs buy additional lines for installed switches as well as new lines for new switches. The additional lines for installed switches actually cost more, as the McGraw-Hill Switch Cost Study used by the Hatfield Model describes:

> The add-on market provides significant revenue potential for switch suppliers, particularly as the margins on new switches remain below the margins for the add-on market. A digital line shipped and in place will generate hundreds of dollars in add-on software and hardware revenue during the life of the switch. Suppliers can afford to lose a few dollars on the initial (new) line sale in exchange for the increased revenue in the after-market, where prices are less likely to be set by competitive bidding. Northern Business Information, *US Central Office Equipment Market – 1994,* McGraw-Hill, p. 71.

[16] To represent this dynamic optimization problem, the proxy model cannot simply be designed to build on a one-time basis enough capacity to meet the current level of demand; this will always understate the true costs over any reasonable time horizon. Since the models do not optimize, they must approximate the solution to the optimization over time through the appropriate choice of inputs, such as fill factors. Moreover, because both incumbent LECs and new entrants must optimize over time, there is no inherent difference between the costs of the incumbent and the cost of an efficient entrant. However, if the model does not capture dynamic optimization accurately, it may create the appearance of such a difference, since the incumbent's costs will include dynamic effects.

[17] *See, e.g.,* Comments of GTE, CC Docket No. 96-45 (filed Dec. 19, 1996) at Attachment 2.

detailed criticism of the Hatfield Model's approach to determining switch investment. As explained therein, the Hatfield Model disregards accepted switch engineering guidelines, fails to model all significant switching components, excludes appropriate element costs, incorrectly uses data, and ultimately fails to produce results that represent the required investment for switching services. GTE's critique of the Hatfield Model's interoffice transport component is contained in section II.B below, in response to the Commission's specific question regarding the adequacy of Hatfield's interoffice transport algorithm.

Third, even if the chosen model did produce accurate results for all providers of universal service, the level of support still would be inadequate. This is so because the Commission will consider revenues (but not costs) from services other than the core services included in the universal service package when calculating the support amount.[18] Of necessity, therefore, the Commission's approach will not produce sufficient support to offset the costs of providing universal service.[19]

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[18] The "'core' or 'designated' services that will be supported by universal service support mechanisms" are "single-party service; voice grade access to the public switched network; DTMF signaling or its functional equivalent; access to emergency services; access to operator services; access to interexchange service; access to directory assistance; and toll limitations services for qualifying low-income consumers." *Universal Service Order*, ¶ 61. In contrast, the Commission has stated that it will count revenues not just from the core services, but also from discretionary services, interstate and intrastate access charges, and unspecified "other telecommunications revenues." *Id.*, ¶¶ 259-262.

[19] The Commission correctly notes that discretionary and access services currently contribute toward universal service. *Id.*, ¶¶ 260, 262. However, by using this as a justification for including revenues from these services when calculating the support amount, the Commission erects a substantial roadblock to more rational pricing; in essence, it institutionalizes major sources of implicit cross-subsidy, despite Congress's

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If the Commission chooses to pursue an approach that intentionally understates the costs of providing universal service, it must realize that it will run afoul of Section 254 and exacerbate the stranded cost recovery problem. A certain level of costs must be recovered through the combination of local rates, interconnection prices, universal service support, and an embedded cost recovery surcharge. Under GTE's approach to universal services support, the stranded cost recovery problem will be minimized. Under the approach outlined in the FNPRM, this problem will be large, contentious, and undoubtedly resolved by the courts.

For these reasons, GTE objects to the fundamental premise underlying the FNPRM. The Commission should abandon its efforts to develop a mandatory cost proxy model for determining the costs of providing universal service and instead permit carriers, at their option, to use state-approved engineering models to identify those costs. In the long run, of course, the best way to assure sufficient and efficient universal service support is to develop a market-based auction mechanism along the lines advocated by GTE.

Against this background, and without prejudice to its ability to object to the *Universal Service Order* on appeal, GTE responds below to certain issues raised in sections III.C.3 and III.C.4 of the FNPRM. These responses should not be taken to imply either that GTE supports any cost proxy model or that adoption of the platform-

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(...Continued)
direction that universal service funding be made explicit. Indeed, by impeding the states' ability to move toward economically rational pricing of certain intrastate services (e.g., discretionary services and intrastate access), the Commission transgresses the jurisdictional boundary contained in Section 2(b).

related modifications suggested by GTE would cure GTE's objections to basing universal service support on hypothetical forward-looking costs.

II. THE FNPRM DISREGARDS REAL-WORLD ILEC PRACTICES, WHICH ARE THE BEST EVIDENCE OF EFFICIENT INVESTMENT.

A. Switching-Related Issues (Section III.C.3)

The FNPRM seeks comment on platform design issues related to host/remote deployment, capacity constraints, and percent of switch assigned to port and to provision of universal service.[20] GTE's comments regarding these matters are discussed below.

1. Host/remote deployment (Section III.C.3.a.)

The FNPRM tentatively concludes that the selected costing mechanism should include an algorithm that places host switches in some wire centers and remote switches in other wire centers, and that the host-remote configuration "is more cost-effective in many cases than employing stand-alone switches."[21] It also asks parties to provide engineering and cost data to demonstrate the most cost-effective deployment

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[20] The Commission also sought comment on input value issues related to switching, including most notably switching costs. In some cases, such as capacity constraints and percentage of switch costs allocated to port and to universal service, the Commission sought comment without distinction on both platform and input value issues. In those cases, GTE's comments address the issues GTE believes should be classified as platform issues. Its comments regarding the input value issues will be filed in accordance with the schedule set forth in the FNPRM.

[21] FNPRM, ¶ 122.

of switches in general and host/remote arrangements in particular and to comment on how to design an algorithm to predict this deployment pattern.[22]

The Commission is engaging in a pointless inquiry. While it is conceivable that an algorithm could be designed to predict whether a host or remote should be employed in a particular wire center, doing so would be extremely difficult and essentially irrelevant. The best indicator of where a company should deploy a host or a remote is the actual practice of that company. When GTE plans its switching network, it places primary emphasis on deploying the most cost-effective possible arrangement. Approximately 60 percent of the switches in GTE's territory are remotes, and industry sources estimate that, by the year 2000, approximately 60 percent of all switches in the United States will be remotes.[23] In determining whether to place a host or a remote, GTE considers the overall calling rate, the ultimate quantity of lines (forecast demand), and the community of interest.

Indeed, LECs typically perform detailed economic and engineering studies before placing remotes. The Bellcore Local Exchange Routing Guide (LERG) identifies the location of existing remotes, and therefore reflects the output of the detailed studies that have been performed by the LECs. Rather than developing a new methodology or "proxy" for estimating these locations and corresponding costs, the information

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22 *Id.*

23 Northern Business Information, U.S. Central Office Equipment Market: 1996 Edition, at 66. The Commission's model cannot simply use a 60/40 remote-to-host ratio, however, because the mix of switches will vary considerably in different geographic areas.

contained in the LERG should be used to identify remote locations. This would allow all parties to take advantage of the economic analysis already performed, and would more accurately reflect the configuration and the costs of the LEC's networks.

In any event, if the Commission's algorithm specifies a different arrangement than exists in the real world, it would be unreasonable to expect that carriers will then conform their networks to the predicted outcome.[24] They will instead keep their existing network design and continue to incur all associated costs. Any difference between those costs and the cost level deemed "efficient" by the Commission will detract from the sufficiency of universal service funding. Moreover, any assumption that carriers will conform their networks to the architecture predicted by the model would be inconsistent with the Commission's requirement that the model utilize existing switch locations.[25] There is no basis for concluding that a remote switch, if deemed more efficient by the model, would be placed at the same location as an existing host switch. Consequently, including a host/remote algorithm in the model would guarantee insufficient support, in violation of Section 254,[26] and be tantamount to a "scorched earth" approach, in violation of the principle that existing wire center locations must be used.

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[24] The Hatfield model is singularly unsuited to determining optimal placement of hosts and remotes. It does not model the host/remote architecture and therefore does not have the capability to perform a cost-per-line calculation based on the combination of host and remote offices.

[25] *Universal Service Order*, ¶ 250.

[26] The insufficiency would arise from a carrier employing a more expensive host switch rather than a less expensive remote switch.

2. Capacity constraints (Section III.C.3.b.)

The FNPRM tentatively concludes that the cost model should "assign more than one switch to a wire center whenever the mechanism predicts that any one of a set of capacity constraints would be exceeded," and seeks comment on what capacity constraints the selected mechanism should adopt.[27] It is certainly true that capacity constraints must be considered in determining how many switches will be used in a wire center. Once again, however, there is no need to develop an algorithm: carriers already have optimized the number of switches in each study area, based on their knowledge of switch capacities, projected market growth, population shifts, and similar factors. The Commission's proposal to disregard the number of in-place switches unreasonably assumes, without any record basis, that carriers have not acted efficiently in sizing their switching facilities. This proposal also is inconsistent with the principle that existing switch locations must be used. If there are ten existing locations in a study area, there are ten switches – and if a model determines there should be eight or twelve switches, then it necessarily violates the existing wire center location principle.

There are other compelling reasons to rely on real-world switch placements rather than assuming that the hypothetical number of switches calculated by the model is more efficient. BCPM and Hatfield only look at capacity constraints in the study area as a whole. In reality, however, capacity constraints must be examined on a more disaggregated basis, considering such factors as location-specific technical

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[27] FNPRM, ¶ 124.

requirements and the anticipated rate and amount of population growth in different parts of a study area. Accordingly, the Commission should utilize actual switch deployment (and the actual costs associated with those switches) rather than attempting to model a hypothetical, unrealistic switching network.

B. Issues Related to Interoffice Trunking, Signaling, and Local Tandem Investment (Section III.C.4.)

The FNPRM states that the platform should estimate the cost of interoffice trunking, signaling, and local tandem facilities used for the completion of local calls, but not for interexchange access.[28] It also tentatively concludes that the Hatfield platform is "adequate" because it can generate cost estimates for each of these facilities, and seeks comment on the accuracy of Hatfield's transport algorithm.[29] There are several profound problems with the FNPRM's approach to transport costing issues.

1. The Commission Arbitrarily Excludes the Costs of Transport Facilities Used for Interexchange Access While Including Revenues from That Service in Determining the Amount of Support.

It is patently arbitrary to ignore the costs of transport facilities used for interexchange access while including revenues from interexchange access when determining support levels. The best approach is to include only local service-related transport costs and count only local service-related revenues. However, if the Commission insists on offsetting universal service costs with interexchange access

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[28] FNPRM, ¶ 139.

[29] *Id.*, ¶ 141.

revenues, it must include all associated transport costs. Failure to do so inevitably would produce insufficient support for universal service, in violation of Section 254.

2. The Hatfield transport algorithm is seriously flawed in numerous respects.

Any proxy model designed to accurately forecast the costs of interoffice facilities ("IOF") must have the following minimum set of features:

- In keeping with the Commission's requirements, it should start with the physical location of existing LEC switches.
- It should provide for the existence of both host and remote switches, and differentiate between facilities that connect a remote switch to its host and those that connect hosts and stand-alone switches to a tandem.
- It should calculate airline miles based on actual office locations, and the route-to-air ratio should be a user adjustable input (preferably with a provision for adjustment below the statewide level).
- The selection of physical increments of plant and the allowable level of fill on that plant should also be user adjustable.[30]
- On point to point routes, allowance should be made for physical diversity in order to meet the required standards for reliability. Alternatively, a 100% SONET ring architecture would provide the required reliability. The model should demonstrate that the facilities modeled would, in fact, provide connectivity for all of the switches in question.

The Hatfield Model fails to meet these requirements and therefore should not be used as the basis for USF IOF cost development. As discussed below, the model's method of calculating interoffice facility routes and route distances is inconsistent with

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[30] For example, when the required capacity of a route exceeds that of an OC3 facility, the user should be able to designate the use of a second OC3 or the step up to an OC12. Also, typical engineering design would require that one fiber pair of an OC3 facility be retained as spare, implying an allowed maximum fill of 66%. These factors reflect a lumpiness of plant that is lost when one uses broad averages as Hatfield does.

forward-looking switch designs and resulting route designs. The net effect is to understate interoffice route distances, associated structures, and the required quantities of certain IOF network components.

a) The Hatfield Model Understates Route-to-Air Ratios.

The Hatfield Model assumes a SONET fiber ring IOF architecture for the larger "on-ring" central offices and a point-to-point OC-3 architecture for the small "off-ring" offices. For "on-ring" offices, the Model calculates the total area of the CBGs served by each of the modeled central offices. Next, the model assumes that each wire center is located in the center of a perfectly square serving area, which is the same size as every other serving area, and calculates IOF distances based on that assumption. Specifically, the model takes the square root of the serving area and multiplies that value by 1.5 to estimate the route distance required to reach the outer boundary of the serving area in two directions.[31]

Off-ring offices have route distances developed by the use of right angle routing, assuming the two points on the route are the central office location and the nearest

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[31] In theory, the imaginary fiber ring is interconnected from one office to the next by virtue of an assumption that the "on-ring" central offices serve adjacent, perfectly square areas. This approach could produce a maximum route-to-air ratio of 1.5 if, and only if, every IOF route passed through the center of one side of each of the square serving areas, and if each serving area were a perfect square with boundaries that contained sides congruous with adjacent serving areas. A further assumption to produce the maximum possible 1.5 route-to-air ratio must be that all serving areas are equal in size. If the IOF route passed through the corners of two serving areas, containing a congruous point at one of each of their respective corners, the resultant route-to-air ratio would be 1.06, as shown in IOF Distances Examples 1 and 2 in Attachment A.

tandem location. This approach for off-ring offices can produce route-to-air ratios ranging in value from 1.0 up to 1.41, as shown in Attachment A. The average route-to-air ratio that could be produced by this method is 1.27. These route-to-air ratios are, however, significantly understated. Hatfield has made no attempt to compare the resulting IOF distances to either actual route distances required on a forward-looking basis or to the actual current experience of any LEC or other utility. This theoretical approach is grossly inaccurate and inappropriate. The proper way to model the IOF is to actually identify the wire centers to be interconnected on the rings, calculate the actual airline distance, and provide a user-adjustable input for the route-to-air ratio.

The model also contains numerous erroneous assumptions relative to the IOF. First, it improperly classifies switches. The small "off-ring" switches are assumed to be stand-alone switches. In practice, LECs normally do not deploy small stand-alone switches; instead, they utilize remote switches.[32] Remote switches are interconnected with their respective host switches via DS-1 "umbilicals," which allow the remotes to take advantage of the host's common resources. A minimum of two umbilicals are required per remote office. Ideally, these umbilicals should be routed on separate IOF facilities or SONET rings. However, the Hatfield Model does not model host-remote arrangements or umbilicals, and does not use separate IOF routes for small off-ring offices.

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[32] As noted in Section 11.B.1 above, remote switches comprise over 60% of GTE switches deployed in the U.S. today.

Second, the Model incorrectly models the majority of IOF routes. Generally, the host switch locations are not the tandem locations. Thus, the small off-ring offices have their associated routes and route distances modeled to the wrong locations. Over 60% of the GTE offices are in fact remotes and should be modeled as remotes. In view of the significant number and high percentage of remotes, the "on-ring" offices are obviously not going to be adjacent to one another, let alone serving perfectly square areas.

Third, the Hatfield Model produces mathematically impossible route-to-air ratios. Indeed, the proponents of the Hatfield Model have not even calculated the route-to-air ratios as a simple but effective check on the reasonableness of the lengths of the required IOF to provide connectivity of the modeled IOF network. A route-to-air ratio is a basic measurement of routing efficiency. The closer a company can get to 1.0 (straight line), the more efficient it is. There are obviously many obstacles to straight-line routing, such as bodies of water, mountains, highways, buildings, and the inability to obtain rights-of-way. AT&T's Total Incremental Cost Model (which that company has used to determine costs for special access and private line service, and which may be used to determine loop costs) therefore uses a route-to-air ratio of 1.6.[33] This is considerably higher than the highest possible ratio obtainable in the Hatfield Model. Any mechanism that is chosen by the Commission should allow the user to vary the

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[33] AT&T's Response No. 10 to Pacific Bell's Third Set of Data Requests Submitted in the California OANAD proceeding.

ratio to reflect the particular circumstances of a given geographic area or service territory.

GTE has quantified the understatement of IOF costs for on-ring offices for several states in the GTE serving area in order to depict the erroneous IOF assumptions incorporated in the model. In order to do this, the airline mileage associated with on-ring offices was calculated. As in Hatfield, all end offices currently serving 5,000 lines or more were assumed to be on-ring. The optimum ring arrangements that would minimize distances were then calculated.

The results of GTE's study are displayed below and clearly illustrate the faulty assumptions contained in the Hatfield model with respect to on-ring IOF costs. Maps depicting the actual rings used to calculate the information below are found in Attachment B.

GTE Analysis of Hatfield IOF Model				
GTE Jurisdiction	**Route Miles (Calculated Using Hatfield Methodology)**	**Air Miles (Determined using V & H Coordinates)**	**Route-to-Air Ratio**	**IOF Facility Shortfall**
Washington	451.3	601.6	0.750	150.3
New Mexico	245.8	816.4	0.301	570.6
Hawaii	335.9	790.3	0.425	454.4
California-Santa Monica	176.9	180.6	0.980	3.7
Idaho	94.3	220.9	0.427	126.6
Average	**260.84**	**521.96**	**0.499**	**261.12**

In every state, when the air mileage that was calculated for on-ring offices was compared to the route mileage calculated using the Hatfield methodology, the resultant route-to-air ratio is less than one. This condition is impossible from both a mathematical and an engineering standpoint. The implication, when one assumes that a reasonable route-to-air ratio is somewhere in the vicinity of 1.6, is that Hatfield's IOF investment costs are significantly understated. There are several contributors to this understatement of route mileage.